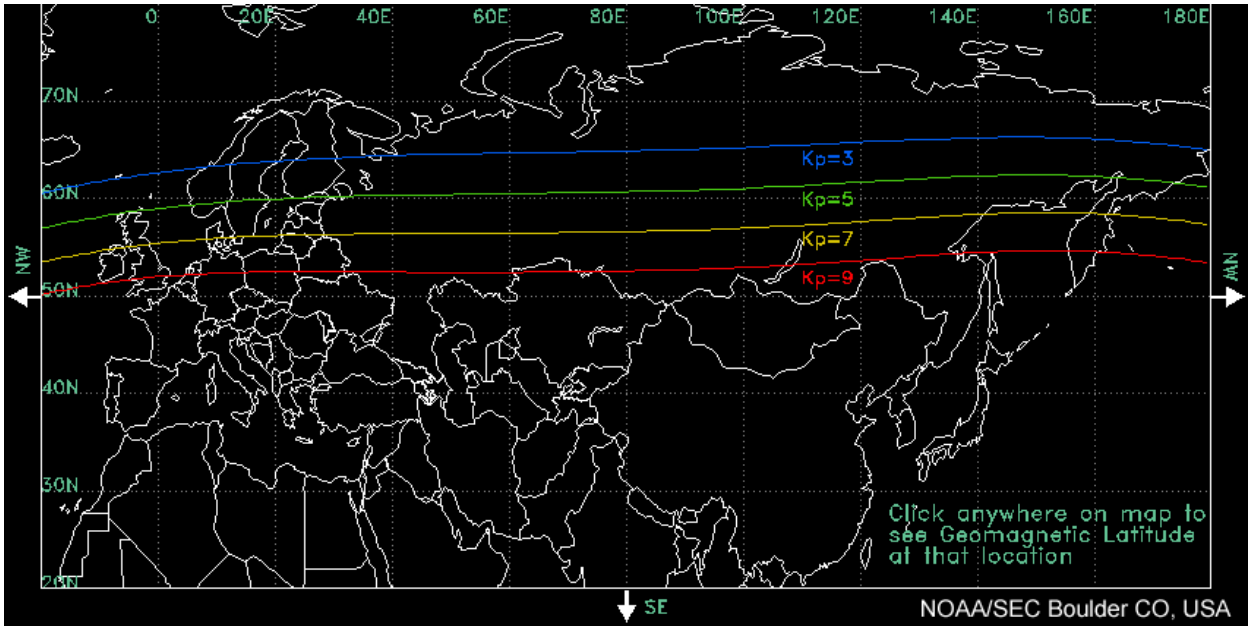
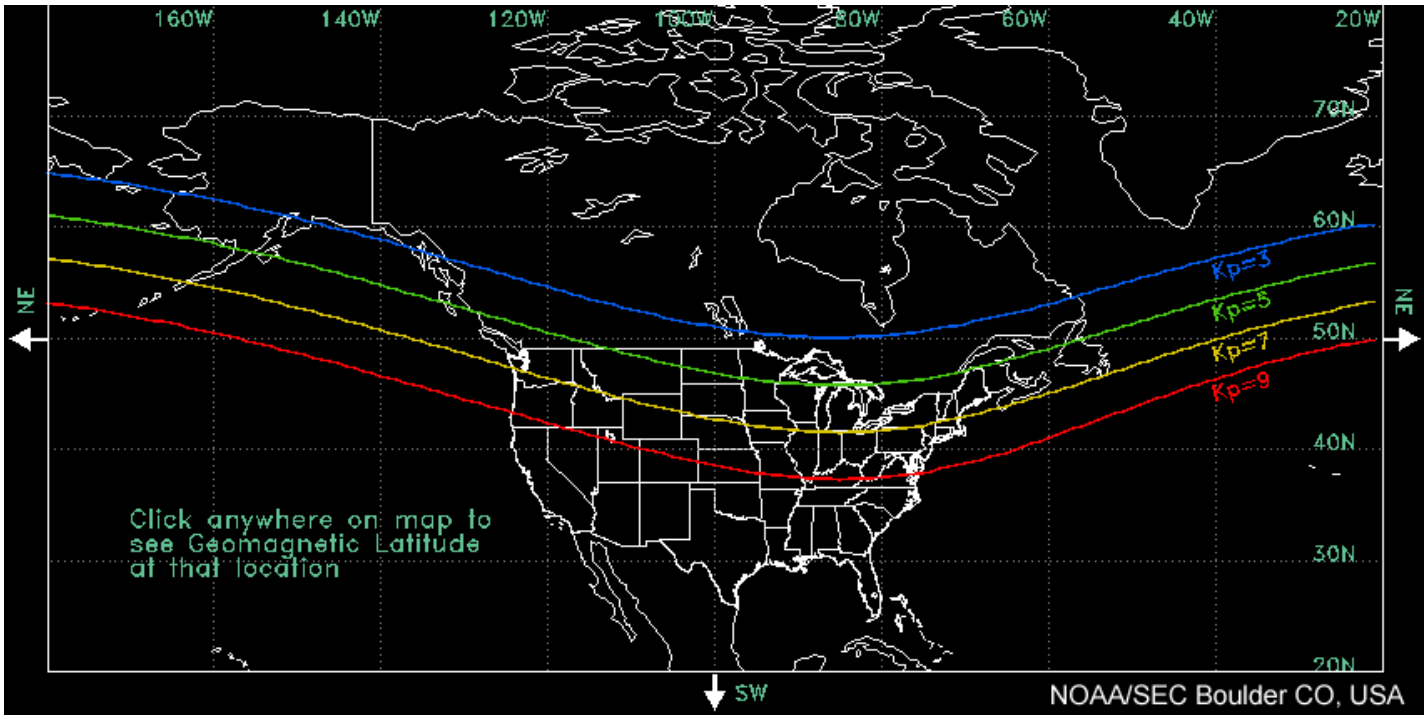



## Magnetic North Pole

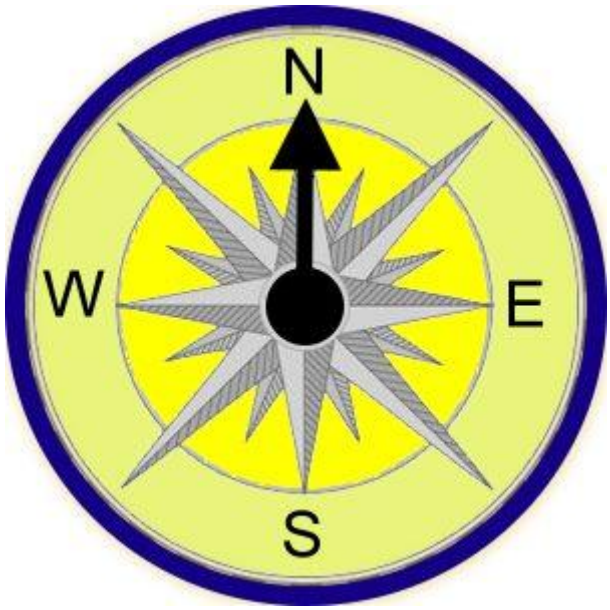
The Magnetic North Pole was discovered on **1 June 1831**.

**Did you know that the earth is home to two North Poles located in the Arctic region - a geographic true North Pole and a magnetic North Pole?**

The true north pole and the magnetic north pole are not in the same place.

**True North (geographic North Pole)**: the northernmost point on the earth's surface. It is the top of the Earth's fixed "axis" upon which it spins. The North Pole is about 450 miles (725 km) north of Greenland in the middle of the Arctic Ocean. Most of the time, sea ice covers the North Pole.

**Magnetic North**:is the place where compass needles actually point. Magnetic north is located hundred of miles south of the geographic North Pole lies the magnetic North Pole at approximately 82.7° North and 114.4° West (2005), northwest of Canada's Sverdrup Island.




#### Who discovered the Magnetic North Pole?

James Clark Ross (1800-1862), commander in the British Navy and an experienced Arctic explorer, discovered the Magnetic North Pole on 1 June 1831.

#### The wandering magnetic North Pole

When the magnetic north pole was revisited in 1904, explorers found it had moved by 50km (31 miles) from where it had been when first discovered in 1831.

In 1989 it sped up again, and in 2007 scientists confirmed that the pole is now galloping toward Siberia at 34 to 37 miles (55 to 60 kilometres) a year.

**Earth's north magnetic pole is racing toward Russia** at almost 40 miles (64 kilometres) a year due to magnetic changes in the planet's core, new research says.

Babaie, Hassan A., 2001, The Brunton® Compass and Geological Objects. Georgia Geological Society Guidebooks, v. 21, No. 1, October, p.55-60.

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## Introduction

The Brunton® compass is used by more geologists for field mapping of geological objects than other brands. This preference, especially in North America, is because Brunton provides a precise sighting-clinometer and hand level capability, and can be used at both waist and eye levels; advantages that are absent in other brands such as Silva which lacks a leveling system for sighting bearings (Compton, 1985). Detailed measurement of geological objects, such as fold hingeline, axial trace, and axial plane, and geological mapping becomes essentially impractical without the use of the compass (i.e., Brunton). In this paper, we will review the application of the Brunton compass in the measurement of a variety of planar and linear geological features (e.g., structural, sedimentary, stratigraphic), and discuss the use of the compass in mapping and measurement of stratigraphic sections, vertical angles, height, etc. Some discussions are given in the context of the lower hemisphere stereographic projection of the geological objects for the sake of clarity and practical value.

## The Brunton Compass (Pocket Transit)

The Brunton compass was originally designed by a Canadian geologist named D.W. Brunton, and built by William Ainsworth Company in Denver, Colorado. Despite its tough design, its delicate mirror and glass components are vulnerable to shock and moisture (if not water proof), requiring care and periodic maintenance for proper application. See Compton, 1985 for maintaining the compass. Since 1972, genuine Bruntons are manufactured by the Brunton Company in Riverton, Wyoming, which was acquired by Silva

Production, AB of Sweden in 1996. Cheaper Chinese, Japanese, and German copies of the Brunton design are also available in the market.

The Brunton Compass

Brunton compasses have three main parts, box, sighting arm, and lid. The box contains most of the components: the needle; bull's eye level (round level to read horizontal angles); clinometer level (barrel-shaped) and clinometer scale (for reading vertical angles); damping mechanism (to more efficiently stabilizing the needle); lift pin (to lock the needle); side brass screw and index pin (to set and display the declination); graduated circle or card (to read the bearing). The needle has two ends: the north-seeking end (commonly white in genuine Brunton compasses, labeled 'N' in others), and the black, south-seeking end. The north-seeking end of the needle is pulled down in the northern hemisphere where the magnetic inclination is downward. An additional small weight attached to the south-seeking end of the needle provides proper balancing of the needle. The weight needs to be reversed if using the compass in the southern hemisphere where the magnetic inclination is upward.

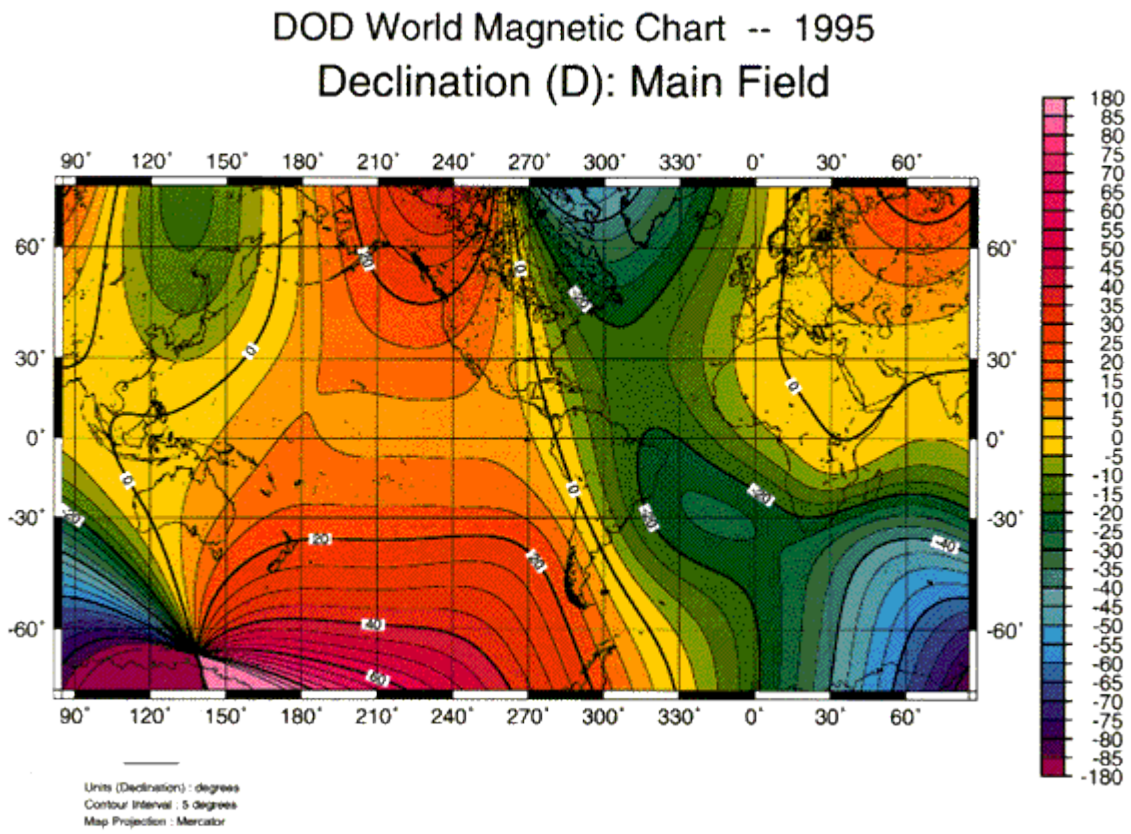
The lid, attached to the box with a hinge, contains the mirror with the axial line and oval sighting window (for waist- and eye-level sighting), and the sight. The long sighting arm, attached to the box with a hinge, has a long, oval rectangular cutout or slot (for reading linear objects), and a tiltable sighting tip, which is used for aligning the line of sight. The circle card of the Brunton compass is designed in two traditional scales. The azimuth scale uses three digits, with north at 000o or 360o, and south at 180o. The quadrant scale uses an alphanumeric notation (e.g., N60oE, S20oW) with the card graduated in four 90o quadrants (NE, SE, SW, NW); north and south lie at the two upper and lower 0o marks, respectively.

The direction of a line on the ground is given by the bearing of the line, which is the horizontal angle between the line and a reference, commonly north in the quadrant scale, or 000o (marked as 0o on the card) in the azimuth scale. The reference, however, can also be the south (S) in the quadrant scale, when reading the bearing (i.e., trend) of south-trending linear objects. The position of 'E' and 'W' are reversed on the circular card; 'E' lies left of the 0o mark (i.e., at 9 o'clock), and 'W' is to the right of the 0o (i.e., 3 o'clock) mark on the card. The reversal is designed to make the correct reading of the bearing possible. To appreciate this fact, notice that the north-seeking end of the needle always stays pointing north even when the compass dial is rotated. For example, to read a bearing of 045o, we level the dial and then turn right of north, but the north-seeking end of the needle turns to the left of 0o, which is actually east on the dial; so we read a correct bearing.

The Earth has geographic or true N and S poles, where the rotation axis

intersects the Earth's surface, and magnetic poles, where the magnetic lines of force emerge (magnetic S) or converge into the Earth (magnetic N). As a magnetic device, the needle of the Brunton compass (a magnet), when freely suspended, seeks the magnetic poles, which generally are not the same as the true north, except in some areas on Earth. A compass needle is a magnet, and the north pole of any magnet is defined as the side which points to the magnetic north when the magnet is freely suspended. The correct name for this end of the needle is "north seeking pole". Maps label the magnetic pole in the northern hemisphere as the "North Magnetic Pole".

The angle between the true north and the magnetic north is called magnetic declination. Declination varies with location, time (secular, diurnal), local magnetic anomalies, altitude (negligible), and solar magnetic activity (Goulet, 1999). Declination is therefore the angle between where a compass needle points and the true North Pole. Magnetic declination is constant along the so-called isogonic lines. The 0° declination (agonic) line passes west of Hudson's Bay, Lake Superior, Lake Michigan, and Florida. The N magnetic pole was positioned in 1999 at 79.8° N, and 107.0° W, 75 in the Canadian Arctic, 1140 km from the true N. The vertical angle between the magnetic vectors relative to the level (horizontal) ground is the magnetic inclination, which varies with latitude; it is 90° at the north magnetic pole, and 0° at the magnetic equator.




Determining the magnetic declination
If the compass needle points east or west of the true north, the offset is called east or west declination, respectively. The standard is to use the

magnetic north (MN) as a reference for declination, even in the southern hemisphere. To determine the magnetic declination in a study area we can use: (1) Published topographic maps; some maps display an out-of-date declination indicated by the angle between two arrows pointing to the magnetic north (MN) and true north (GN). (2) Published or online isogonic charts, which are available at: http://geomag.usgs.gov/chartsdo.html, or http://geomag.usgs.gov/models.html. (3) Online calculator to determine the latest magnetic declination for a given location (latitude and longitude) and yearhttp://www.geolab.nrcan.gc.ca/geomag/e_cgrf.html or http://www.resurgentsoftware.com/geomag.html

Setting the declination

Geologists use the compass for mapping and measuring linear and planar objects. The magnetic declination is set by turning the brass screw on the side of the compass box. For a west declination of say 16o (i.e., declination is 16o west of true north), turn the card west, i.e., counterclockwise (by turning the screw) so that the index pin points to 16o on the side of the card marked with 'W' in the quad scale, or 344o in azimuth scale. For an east declination of 16o, turn the card east (i.e., clockwise), so that the index pin points to 16o on the side of the card marked with 'E' in the quad scale, or 016o in azimuth scale.

The concept of domain

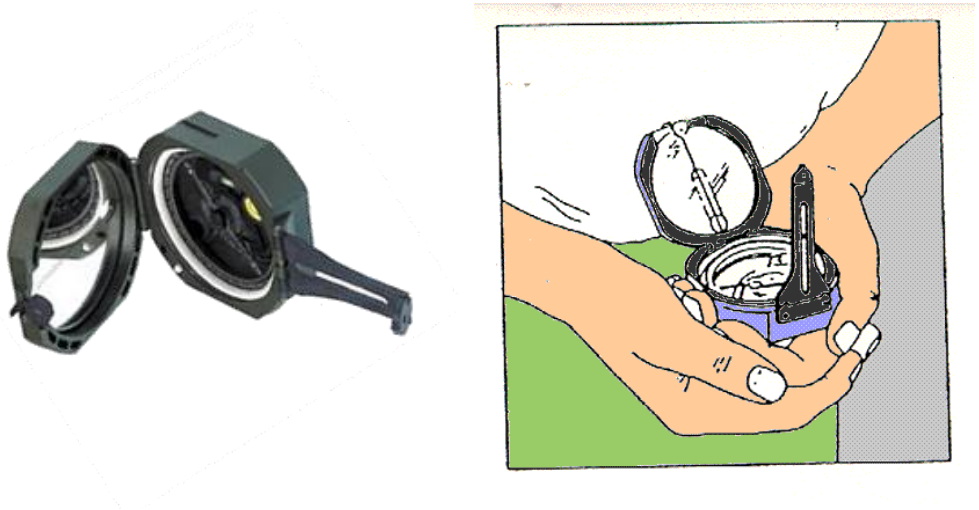
One of the objectives of studying a complexly deformed area (e.g., refolded folds) is to identify domains (subareas) within which the fabric data of, for example, folds, lineations, foliations are homogeneous. This means, for example, that the hingelines and/or fold axes, and the poles to the axial planes (or axial planar foliation, if it exists) of all minor folds define maxima (i.e., cluster distribution), with the mean axis lying on the mean axial plane. The boundaries of the domains are identified (mapped) by locating the adjacent stations at which specific fabric data are homogeneous. The homogeneity in each domain reflects two major facts: (1) Homogeneity of the strain which results in equal extension in a strain field in which the axes of the maximum principal extension are parallel at every point, keeping originally-parallel lines and planes parallel, and straight lines straight. (2) Homogeneity of the rock, i.e., rock properties is the same at each point in the rock continuum during the deformation. Geologists cannot produce a useful map of, or obtain useful information from, moderately- to highly-deformed areas, without knowing how to use the compass to collect the fabric data and to delineate the domain boundaries. Thus, we need to know how to measure linear and planar objects of all kinds, such as sedimentological and structural fabric elements, and map lithostratigraphic boundaries such as contacts.

Attitude of linear and planar geological objects
Although most geologic structures are generally either curvilinear or curviplanar, they can be approximated as either linear or planar at specific scales or domains. For example, a primary linear structure such as the crest of ripple marks or flute casts on a bed may be folded around the axis of a fold. At the scale of a large fold, these linear objects are curved, i.e., have a systematically distributed orientation (e.g., small circle or great circle distribution). However, within each limb of the fold (a domain), the orientation of these structures may be homogeneous, that is, the flute casts or ripple crest are subparallel to parallel. On each limb, the fabric data of minor folds may have a homogeneous distribution.

The attitude of both linear and planar objects has two general components: bearing and inclination. Bearing is the horizontal angle between a line and a specified reference (N or S). The "line" either is the horizontal projection of an inclined linear object, or a horizontal line on an inclined plane. Bearing is a scalar feature, i.e., it just is a number (e.g., 045o or N45oE). Inclination, on the other hand, is the vertical angle between a linear or planar object and the horizontal. The convention for direction of inclination is down, i.e., we measure the angle from the horizontal down (not up), especially when we process the data on the lower hemisphere, equal area projection (mineralogists also use the upper hemisphere for crystals). Inclination is a vector, meaning that it has two components: an amount (angle below the horizontal), and an orientation specifying the direction to which the planar feature is inclined down (e.g., 30oNW).
Attitude is too general, and its two components: bearing and inclination, take different meanings when dealing with linear and planar element. For planar features such as bedding (the boundaries of a bed), fault, and foliation, the bearing and inclination become strike and dip. Note that strike is a scalar, and dip is a vector. Strike is the bearing of a horizontal line on an inclined plane. Since strike is the bearing of a horizontal line, we can read the bearing of either of its ends; thus, 000o and 180o are the same strike. Dip is the inclination of an inclined plane. For linear fabric such as hingeline, axis, or lineation, we use trend and plunge to represent the bearing and inclination. Notice that horizontal planes don't have any strike because they don't intersect the horizontal along a line.

Trend is the bearing of a linear object measured in the direction to which the line is inclined down. Plunge is the amount of the inclination of the linear feature. Thus, both trend and plunge are scalars; together they define the line vector. For example, a 060o, 30o (also written as 30o, 060o, or 30o,

N60oE) is a pair of trend/plunge (direction/magnitude) or plunge/trend, which means that a line plunges 30o down below the horizontal in the 060o direction. Linear objects can also be defined by their pitch on a specific plane. Notice that vertical lines don't have any definable trend, and that the trend of a non-horizontal linear object must be read from a reference (e.g., N) to the direction that the line plunges. Thus, a trend of 000o and 180o are not the same thing (contrast this with strike!). In practice, it is extremely difficult, if not highly error-prone, to measure the trend of steeply plunging linear object; in such cases we use pitch. Notice that the trend of any line on a vertical plane is the same as the strike of that plane (a useful geometric fact). Pitch is the acute angle measured on a plane, from the strike of the plane that contains the line, toward the line (the sense is important!). For example, a pitch of 40oSW (read as: 40o from SW) means that the line is pitching 40o from (not to!) the SW end of the strike line of a plane that contains the line. Notice that pitch generally is not a horizontal or vertical angle, except for horizontal and vertical planes containing linear features. Pitch is an alternative to trend and plunge, although, sometimes, it is the only practical way of measuring a line correctly, especially if the line is steeply plunging.



Measuring the attitude of linear objects
Measuring trend and plunge: If the linear object is below our line of sight, open the sighting arm and the lid, and align the open, long slot of the arm parallel to the linear feature. If the linear feature is above our head (e.g., on a bedding above us), stand under the object and align the linear feature with the black axial line on the mirror on the lid of the compass. In either case, level the bull's eye, round level while aligning. If the linear object is plunging, only one of the needles (the north-seeking or the south-seeking) indicates the true trend of the linear feature. This is a case where many inexperienced geologists can make a common, critical mistake! Some people have the habit of only reading the north-seeking (white) needle of the compass, or vice versa, which is an error-prone practice. When using the Brunton compass we should be color-blind, and only read the direction of the needle that is correctly indicating the direction to which the line is

plunging (down, not up!). Thus, the trend of only one of the needles is correct when reading a line. To figure out which one, we should be aware of the local geographic directions, that is, know the direction of north or south in the field at all times. For example, if we are measuring a linear object plunging down to the south (S or somewhere in the SE or SW quadrants), we must read the trend indicating any one of these southern directions (e.g., 120 o or S60 o E), and not the diametrically opposite northern directions (i.e., 300 o or N60oW) indicated by the opposite end of the needle. For a plunging line, 120 o and 300 o are not equivalent; only one is the true down direction (120 o or S60 o E in this case). The true direction of the trend may be indicated by the white or the black needle; the color depends on how we hold the compass (sighting arm away or toward our body), and on which way we are facing in the field (looking north or south). Therefore to avoid a common mistake, no matter how you are holding the compass or which way you are facing; just know where the geographic N or S is in the field, and ask yourself this question: Which way is the line going down (i.e., plunging)? If it is plunging to around the N, then read the needle (white or black) that points to N or in the NE or NW quadrants and not the opposite directions. This is the easiest and most practical way of correctly measuring a line. Of course, if a linear feature is non-plunging (a special case), we have the freedom of reading either the white or the black needle, because the line is horizontal (both ends are the same).

Example: We are measuring the crest of a ripple mark which is roughly trending somewhere around north (we know which way is N in the field because we have the compass!). The crest of the ripple mark is plunging, and lies on a bedding, which is dipping. Align the compass's sighting arm with the crest and then read either the direction indicated by the white or the black needle that points somewhere to the north. Thus, if the black needle points to N20oW and the black needle points to the S20oE, we must read the black needle. Don't wrongly assume that the white needle gives you the north readings; a common misconception.

Measuring vertical angles, height, and distance
To measure vertical angles, fold the lid and use the compass as was described for measuring the plunge of lines, i.e., with the clinometer. The vertical angle (q) can then be used to calculate the height (h) of an object (e.g., wall, tower, mountain peak) using the equation h = x tanq, if we know the distance (x) to the object. We can also use the trigonometric functions to calculate the horizontal distance (x) from point A to an object located at point B as follows. Walk from point A to another point C such that AC is perpendicular to line AB. This is done by taking a bearing at 90o to the bearing of AB with the compass. Use a tape or a measured pace (if pace spacing is known). In practice, we define AC to be 10 meters; or walk from A to C by 10 meters with our pace. Read a bearing from point C to point B. Subtracting the two bearings gives the angle b between AB and CB. Now we

have a right angle triangle ABC with AC = 10 m, AB = x, and a known angle b. Use the equation tanb = AC/AB = 10m/x, and calculate x in meters.

If the linear object of interest is steeply plunging, it is better to use pitch instead of the trend and plunge. Measuring pitch is only possible if the linear feature lies on a physical plane. For example, if a set of slickenlines (striations) plunges (e.g., around S) on a fault, we measure the striations as follows. First, measure the plane (i.e., fault) that contains the linear features (see next section for this). Next, measure the pitch of the striations on the fault plane as follows. The Brunton compass has a circular, high relief ring on its back, which is designed for measuring pitch. Open the compass (the arm and lid opened completely) and align the edge of the lid and box with the line while the whole ring on the back of the compass touches the fault. If the clinometer, barrel-shaped level is not centered in this position, gently move the box off the plane and slightly turn the clinometer, and lay the box back on the plane while aligning the edge with the line. If the clinometer is not centered, repeat these steps several times until the clinometer is leveled while the edge of the box is parallel to the line, and the circle behind the compass is completely lying on the plane. This is a trial and error process that requires some practice to master.

Using the compass as hand level on a Jacob Staff
The compass can be used as hand level, mounted on a Jacob Staff to measure the true stratigraphic thickness of a lithostratigraphic unit (e.g., member, formation) as follows. Measure the true dip of the layers and set the clinometer at that angle. Mount the compass vertically (as in reading the plunge) on the Jacob Staff with the lid half closed; making sure that the clinometer is set at the measured dip angle. Start at the lower contact of a stratigraphic unit. Tilt the staff in the direction of the dip of the beds, and look inside the mirror until the clinometer level is centered. At this position, look through the sighting tip and through the sighting window. Identify a point (e.g., a brush, a piece of rock) on the ground where the line of sight intersects the ground. Move the base of the Jacob staff to that point. Use a counter and register the number of times (n) it takes to go from the basal contact of the lithostratigraphic unit to its top. At the upper contact, multiply the length of the Jacob Staff, which is 1.5 meter, by 'n', to get the true stratigraphic thickness of the unit.

Measuring the attitude of planes
If the plane is flat, smooth, and non-magnetic, the easiest way to measure the strike and dip of the plane is to touch the edge of the box (not all the rectangular side!) with the plane while centering the circular, bull's eye level. This will generate a horizontal line parallel to the edge of the box on the plane of interest. We have the freedom of reading either of the two needles; it does not matter which one we read! (e.g., 140o and 320o are the same strikes). This is the strike of the plane; we can mark the strike line on the plane with a pencil drawn parallel to the edge of the box. In special

cases such as when taking oriented samples of rock for structural analysis, we need to distinguish and mark only one of these two ends of the horizontal line with an arrow (preferably with half arrow tip).

After the strike is measured, the magnitude of the dip of the plane is measured by putting the entire rectangular side of the box perpendicular to the strike line and centering the clinometer level. The general, dominant direction of the dip is identified geographically by checking the down-dip direction (by centering the bull's eye level and finding out where the principal geographic directions are). In North America, the format is strike, dip and dip direction (e.g., 050 o, 30 o NW), because that is the sequence of measuring the attitude of a plane with the Brunton compass. Silva and other similar compasses allow easier measurement of the dip direction before or without identifying the strike direction. Thus, in Europe and other places, the format may be dip amount, dip direction, which is a vector (e.g., 30o, 320o).
If the plane of interest is not flat, and lies in front of us at the level of our line of sight, we must use eye-level sighting as follows. Stretch the sighting arm and bend the sighting tip. Close one of the eyes, and move sideways while looking onto the edge of the inclined plane. Stop moving if further moving exposes the surface of the plane. In this position, we are looking edgewise along the plane. Fold the compass lid until we see the edge of the inclined plane in the sighting window through the lid. Hold the compass as follows: Put the two thumbs under the sighting arm on the box; the two index fingers on the edge of the lid, and the center fingers behind the horizontally positioned box. Adjust the lid with the index fingers until the bull's eye level is apparent in the mirror. Center the bull's eye level, and intersect the edge of the plane with the black line in the sighting window (don't try to align the black line with the edge (because it tilts the box) unless the plane is vertical). Hold your breath, and read the bearing indicated by the black or white needle (whichever is apparent in the mirror), that is, the strike of the plane in the mirror without moving the box or going off level. While in the same position, read the amount of dip by aligning the flat edge of the box with the edge of the plane. Determine the direction of the dip by inspection; give the principal direction of inclination from the geographic space as described above.
If the plane of interest is vertical and the terrain is horizontal (a special case), stand directly above the edge of the plane and read the trend of the edge of the plane as the strike. Some inexperienced geologists assume that they can determine the strike of an inclined, non-vertical plane in this way. The technique of standing above the edge of a plane does not work if the plane is non-vertical and/or the top surface is not horizontal. This is because the intersection of a non-vertical plane and non-horizontal plane is not a horizontal line, and thus cannot be a strike! In such cases, we need to directly measure the strike by either eye-level sighting or by touching as

described above.

Measuring the bearing of a line between two points
Commonly we want to measure the trend and plunge of a line connecting two points, e.g., a line connecting a person and another person, or another landmark (e.g., house, tower, smoke stack). To do this we can either use the eye-level or waist-level sighting. The eye-level sighting was described above. For the waist-level sighting, we put the lid against our body, and tilt the lid while holding the box horizontally by centering the bull's eye level. Position the target on the black line on the mirror, and after centering the round level, read the trend.
Measure the plunge of this line as follows. Flip the compass (box is vertical) while the lid and sighting arm are folded. Look through the hole in the sighting tip and through the sighting window, and then center the clinometer level while shooting to a specific point on the target. If the two persons have the same height, intersect the other person's eyes with the black line on the sighting window. If we are sighting (shooting) to another person who is shorter than we are, say by 5 cm, then we shoot 5 cm above that person's eye level (at forehead or head level). If the other person is taller by 5 cm, then we shoot to the mouth level of that person.

Measuring the attitude of a plane with the two-line technique
The two-line technique is a very useful and precise method of measuring subhorizontal and gently dipping planes. Such low-dip planes are very common, and cannot accurately be measured by measuring the strike and dip. If the exposed surface of a plane is small, we drop two sharpened pencils on the plane at high angles to each other. Point the sharp ends of the pencils down-plunge. Measure the trend and plunge of the two lines (l1 and l2). If the subhorizontal plane is large and extensive (e.g., a basalt layer), we define two long lines with two persons. The two persons stand at two points and shoot at each other to determine the trend and plunge of the line connecting them (l1). Take the average of the two readings. They repeat this for a second line by constructing a second line (l2). To determine the orientation of the plane that contains the two lines, plot the lines as two points on the stereonet, and align them on the same great circle. Read the strike and dip of the great circle.
Although the two-line technique is the best way to determine the attitude of subhorizontal or gently dipping layers, the attitude of small, gently dipping planes (e.g., bedding at the hinge zone of a mesoscopic folds) can be determined by trial and error as follows. Measure the dip of the layer where we think is near the maximum inclination (true dip); center the clinometer level. Remember the dip value. While the rectangular side of the box is still completely touching the layer, slowly turn the compass and reread the dip. If the dip is less than the previous reading, then we are going away from the maximum inclination, and our previous reading was closer to the true dip. Move toward the first position and go to the opposite direction. Repeat the process until we identify the maximum inclination which is the true dip.

When the true dip orientation and magnitude is registered, measure the strike of the plane perpendicular to this line.

Using the compass for the two-point problem
Sometimes we may be located at a contact of a horizontal layer (e.g., a basalt layer or a bed) on a hill, and be interested to locate a point of the same elevation on an adjacent hill. To do this, we set the clinometer at the 0o mark, and flip the compass sideways (vertically) as described for measuring the plunge. Look through the hole of the sighting tip, through the sighting window, and center the clinometer level (which is set to 0o) by moving the box up or down and looking in the mirror (without turning the clinometer). When the level is centered, locate a point on the other hill at the intersection of your line of sight and the ground. That point has the same elevation as the point of our position.
This technique is also handy in determining the strike of a layer. Just set the clinometer at the 0o mark; stand on the layer, look along the layer, and center the clinometer without turning the clinometer. After the level is centered, locate a point on the sloping layer along your horizontal line of sight. Now that we know the strike line (the horizontal line), we need to read its bearing either by eye-level or waist-level sighting. While in the same position, read the dip of the layer across the strike line using the clinometer as described for measuring the dip.

References:
Compton, R. R., 1985. Geology in the Field. John Wiley & Sons, New York, 398p.
Goulet, Chris, M. 1999. At: http://www.cam.org/~gouletc/decl_faq.html

Francis Audet

Minor flare

Member

1 posts

Posted 17 March 2014 - 16:29
Hi dear experts,

why is it that for example a Kp of 5 is required to potentially spark Auroras in the mid-west USA, at a lattitude of 46-47 Degrees, while that same Kp will only spark auroras at the 60 Degree in Europe? Has it to do (mainly, totally?) with the non-tru north magnetic north? Or is there something else at play here?

Thanks Location Maldegem, Belgium
Posted 17 March 2014 - 16:50
There is a difference in the geographic north and magnetic north:

Because the magnetic north is more south than the geographic north and that point is situated in favor of the US/Canada, Europe will get less aurorae on middle and lower geographic latitudes.

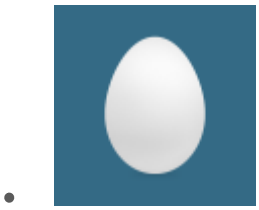
So in Geographic latitude speaking for Belgium: 52°N we need  a Kp-indice of 7 to view aurorae. In magnetic latitudes Belgium is at 45° magnetic latitude. If i look at the city Atlanta in the state Georgia USA it has a magnetic latitude if 44.5° so it's comparable. The geographic latitude is 33°N.

In our help article about the low, middle and high latitudes we have some images with the location of the oval for a given K-indice.

Webmaster & analyst Ruimteweer en Poollicht
Webmaster & analyst Space Weather and Aurora
SpaceWeatherLive.com - SpaceWeatherLive on YouTube
*Donate and support our project - Donneer en steun ons project*

#3 Waldo Hazeleger

Minor flare



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13 posts

Posted 18 March 2014 - 11:38

A nice explanation is on this page.
Here you can see the difference between the magnetic latitudes of europe and north america, and what kp level is needed for auroral activity.